

Weak-Lensing Mass Calibration of SPT Clusters in the SV Data

Standard External Collaborator Proposal

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Participants:

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EXT: Tim Schrabback, Henk Hoekstra, Douglas Applegate, Anna Patej, Tom Crawford, Bill Holzapfel, Nicha Leethochawalit, Brian Stalder (all SPT)

Working Groups: Cluster Working Group, Weak Lensing Working Group

Wiki links:

https://cdcv.sfnal.gov/redmine/projects/desclusters/wiki/Mass_Calibration_of_SPT_Clusters_with_DES_Weak_Lensing

Datasets:

1. DES-SV imaging data, photometry, photometric redshift, and shear catalogs over the DES-SV imaged portion of the sky.
2. SPT cluster candidate list, Y_{SZ} and cluster mass estimates, available ancillary data if it directly benefits the weak-lensing analysis, e.g. spectroscopic cluster redshifts and additional photometric data for enhanced selection of the cluster background population, over the same region of the sky.

Duration: 1 year

Deliverables: Paper with weak-lensing mass measurements and Y_{SZ} scaling relation

Overview:

We propose to use DES-SV data to measure the weak-lensing masses of SPT selected galaxy clusters. The science verification data contains imaging for 96 SPT clusters and cluster candidates. At the time of writing this proposal, 13 of these have confirmed spectroscopic redshifts and a further 33 have photometric redshift estimates from SPT follow-up data. About half of these 46 systems have redshifts where we can expect to measure individual weak-lensing masses from shear in DES data with a signal-to-noise ratio > 1 . We expect that the current data set can constrain the SZ-mass scaling relation to at least 20%. There is, however, significant uncertainty in this prediction since no prior experience with cluster lensing in average SV data exists. In addition to its scientific value, this project will contribute directly to the verification of the science readiness of DES lensing data, among the technically most ambitious analyses to be performed with DES. The higher redshift clusters, for which no

significant shear profile can be measured with DES data, can still lead to a significant magnification signal.

This project has the full support of the DES Weak Lensing Science Working Group, including the Shear Pipeline Subgroup of the WLSWG led by Mike Jarvis. The DES WLSWG shear catalogs will be used for the analysis. There is an ongoing program to test the WLSWG shear codes in the cluster lensing regime led by Julia Young (ClusterSTEP), and the DES participants in this proposal are heavily invested in the success of cluster lensing.

All external collaborators in this proposal are actively involved in existing and proposed weak-lensing follow-up of SPT selected clusters or the preparation of ancillary data. Among these proposed projects is single-passband lensing follow-up of ~65 SPT clusters with Megacam at Magellan at redshifts where DES cannot deliver sufficient SNR. DES, however, can aid this program with multi-band photometry. We view this external collaborator proposal as a pathfinder for a larger one should the Megacam proposal be successful.

This proposal, if accepted, would allow the DES-SV data needed for this project to be accessed by the non-DES members of SPT who are involved in this project, and it would also allow the proprietary list of SPT cluster candidates (i.e. this list includes both published and non-published SPT clusters) to be accessed for the purposes of this project by the non-SPT members of DES. To facilitate the lensing analysis, follow-up data collected by the SPT, which directly benefits the weak-lensing analysis, would also be made available to the non-SPT members of DES. Examples of such data are spectroscopically confirmed redshifts of galaxy clusters and additional imaging data to improve the rejection of foreground and cluster galaxies in the lensing catalogs.

Because of the existing DES-SPT MOU it is expected that this application can be expedited for approval. The key issues that hinge on this application are (1) access of non-DES members of SPT to the DES-SV data, (2) access of non-SPT members of DES to the SPT cluster candidate list over the DES-SV region, and (3) wiki and mailing list access to simplify communication during the period of the project.

The author lists for the papers that result would conform to the rules set out in the DES-SPT MOU.